

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings of claims in the application:

LISTING OF CLAIMS

What is claimed is:

1. (Previously Presented) An optical fiber wiring apparatus for wiring substrate, comprising:

a wheel-less wiring head which guides an optical fiber to a lead end thereof along a guide groove through which the optical fiber slides into position on the wiring substrate, the guide groove extending partially along a length of the wiring head and formatting an optical fiber path;

an optical fiber feed means which feeds said optical fiber during the wiring operation into said optical fiber path of said wiring head;

an optical fiber contact means, which brings an optical fiber, which has been guided to said lead end of said wiring head via said optical fiber path, and said wiring substrate into contact, wherein the optical fiber contacting the means includes an optical fiber pressing means for pressing said optical fiber against said wiring substrate with a predetermined pressure;

an XY movement means, which moves said wiring substrate and said wiring head relative to one another in the X and Y directions in the state in which said optical fiber at said lead end of said wiring head has been placed in contact with said wiring substrate by said optical fiber contact means; and

an optical fiber affixing means, which successively affixes, to said wiring substrate, said optical fiber which has been brought into contact with said wiring substrate during movement by said XY movement means,

wherein in the wheel-less wiring head, a pressure groove connected to said guide groove is formed with a radius of curvature larger than the radius of curvature at which said optical fiber breaks, so as to support the optical fiber in a state in which it is bent by a fixed amount and is pressed onto said wiring substrate.

2. (Previously Presented) An Optical fiber wiring apparatus in accordance with claim 1 wherein

said optical fiber within said optical path of said wheel-less wiring head is successively drawn out when the optical fiber at the end of said wheel-less wiring head is successively affixed by said optical fiber affixing means, and

said optical fiber feed means feeds said optical fiber stocked in said optical fiber path which successively draws out said optical fiber.

3. (Previously Presented) An optical fiber wiring apparatus in accordance with claim 1, wherein

at least said lead end of said wheel-less wiring head has a hemispherical shape and the guide groove guides said optical fiber to the hemispherical part,

said pressure groove is formed in said hemispherical part, and

said optical fiber is guided to the lead end of said wheel-less wiring head via said guide groove and said pressure groove.

4. (Cancelled)

5. (Previously Presented) An optical fiber wiring apparatus accordance with claim 2, wherein

said optical fiber feed means is provided with a deflection detection means for detecting deflection of said optical fiber within said optical fiber path of said wheel-less wiring head or in a path leading to this optical fiber path, and

a deflection maintaining means for maintaining the deflection within a predetermined range based on detection values of said deflection detection means.

6. (Previously Presented) An optical fiber wiring apparatus in accordance with claim 1, wherein

said optical fiber feed means feeds an amount of optical fiber necessary during various successively executed wirings successively into the optical fiber path of said wheel-less wiring head.

7. (Original) An optical fiber wiring apparatus in accordance with claim 6, wherein

said optical fiber feed means is provided with a reverse rotation prevention means which prevents back feeding of said optical fiber and which conducts drawing out of the optical fiber in the direction of feeding without resistance.

8. (Original) An optical fiber wiring apparatus in accordance with claim 7, wherein
said reverse rotation prevention means is a one-way clutch.

9. (Previously Presented) An optical fiber wiring apparatus in accordance with
claim 1, wherein

said optical fiber contacting means is provided with a Z axis actuator which
displaces said wheel-less wiring head in a Z axial direction, and displaces said wheel-less
wiring head in the direction of said wiring substrate and brings said optical fiber at the
lead end of said wheel-less wiring head into contact with said wiring substrate.

10. (Previously Presented) An optical fiber wiring apparatus in accordance with
claim 9, wherein the predetermined pressure with which said optical fiber pressing means
presses said optical fiber at said lead end of said wheel-less wiring head against said
wiring substrate is within a range of 9.8×10^{-2} (N) (10 gf) - 2.0 N (200 gf).

11. (Previously Presented) An optical fiber wiring apparatus in accordance with
claim 1 wherein

at least a part within said optical fiber path of said wheel-less wiring head which
comes into contact with said optical fiber comprises a material having a lower coefficient
of friction than said optical fiber.

12. (Canceled)

13. (Previously Presented) An optical fiber wiring apparatus in accordance with claim 3, wherein

a Z axial rotation means, which rotates said wheel-less wiring head about the Z axis in accordance with a wiring pattern, and orients said pressure groove of said wheel-less wiring head in a direction in which wiring is to be conducted during the wiring operation, is provided.

14. (Previously Presented) An optical fiber wiring apparatus in accordance with claim 13, wherein

said Z axial rotation means is provided with a rotational reference sensor for orienting said pressure groove of said wheel-less wiring head in the direction in which wiring is to be conducted.

15. (Original) An optical fiber wiring apparatus in accordance with claim 1, wherein an optical fiber cutting means for cutting said optical fiber to a predetermined length is provided.

16. (Previously Presented) An optical fiber wiring apparatus in accordance with claim 15, wherein

said optical fiber cutting means is provided with:

said optical fiber path into which said optical fiber is inserted,

a cutter disposed so as to be capable of movement in a direction crossing said optical fiber path, and

an electromagnetic slider which moves said cutter instantaneously in a direction crossing said optical fiber path.

17. (Previously Presented) An optical fiber wiring apparatus in accordance with claim 1, wherein

said XY movement means moves said wheel-less wiring head and wiring substrate relative to one another so that said wheel-less wiring head is positioned outside said wiring substrate;

said optical fiber feed means feeds a predetermined length of said optical fiber when said wheel-less wiring head is positioned outside said wiring substrate, and

by means of this, a predetermined length of optical fiber is fed outside said wiring substrate.

18. (Original) An optical fiber wiring apparatus in accordance with claim 17, wherein

a table which supports said wiring substrate and which has drop holes in the vicinity of said wiring substrate support part is provided, and

a predetermined length of optical fiber is fed into said drop holes of said table and a predetermined length of optical fiber is fed out outside of said wiring substrate.

19-20. (Cancelled)

21. (Previously Presented) A wiring method which conducts the wiring of an optical fiber onto a wiring substrate, comprising:

adjusting the feeding of the optical fiber by an optical fiber feed means so that the tension on the optical fiber is within a fixed range;

wiring the optical fiber fed by the optical fiber feed means onto the wiring substrate by a wheel-less wiring mechanism while the optical fiber is guided along a guide groove formed in the wiring mechanism and is pressed against the wiring substrate with a predetermined pressure; and

cutting the optical fiber to a required length for the wiring by an optical fiber cutting means wherein the step of wiring the optical fiber includes supporting said optical fiber with a radius of curvature larger than the radius of curvature at which said optical fiber breaks, in a state in which said optical fiber is bent by a fixed amount and is pressed onto said wiring substrate.

22. (Previously Presented) An optical fiber wiring method which employs an optical fiber wiring apparatus which is provided with a wiring substrate, a wheel-less wiring head which has a guide groove along which an optical fiber is guided, and applies the optical fiber to said wiring substrate with a predetermined pressure, and an optical fiber feed means which feeds stocked optical fiber, which apparatus moves said wiring substrate and said wheel-less wiring head relative to one another in the XY directions and conducts wiring operations which form a desired optical fiber wiring pattern on said wiring substrate, comprising;

feeding an optical fiber of predetermined length by said optical fiber feeding means, in a manner unrelated to the wiring, either before or after the wiring operation or both before and after the wiring operation, and thereby producing an optical wiring board having optical fibers of a predetermined length connected to said wiring pattern either before or after said wiring pattern by means of the wiring operation or both before and after said wiring pattern wherein the wiring operation includes supporting said optical fiber with a radius of curvature larger than the radius of curvature at which said optical fiber breaks, in a state in which said optical fiber is bent by a fixed amount and is pressed onto said wiring substrate.

23. (Previously Presented) An optical fiber wiring method which employs an optical fiber wiring apparatus which is provided with a wiring substrate, a wheel-less wiring head which is provided with an optical fiber path which guides an optical fiber to a lead end thereof and which applies said optical fiber guided to said lead end to said wiring substrate with a predetermined pressure, and an optical fiber feeding means which feeds stocked optical fiber, which apparatus moves said wiring substrate and said wheel-less wiring head relative to one another in the XY directions and conducts a wiring operation which forms a predetermined optical fiber wiring pattern on said wiring substrate, comprising:

at the initiation of wiring, moving said wheel-less wiring head to a wiring initiation position, and

in the state in which said optical fiber has been guided to said lead end of said wheel-less wiring head along a guide groove formed in the wheel-less wiring head, pressing said optical fiber against said wiring substrate with said predetermined pressure, wherein said wheel-less wiring head is moved along said wiring pattern with respect to said wiring substrate, the required optical fiber is fed into said optical fiber path of said wheel-less wiring head by said optical fiber feeding means, and wiring is conducted; and

wherein the step of pressing the optical fiber against said wiring substrate includes supporting said optical fiber with a radius of curvature at which said optical fiber breaks, in a state in which said optical fiber is bent by a fixed amount and is pressed onto said wiring substrate.

24. (Previously Presented) An optical fiber wiring method in which an optical fiber is laid on a wiring substrate by a wheel-less wiring head, at least a lead end of which is formed with a curved surface, which has formed in a side surface part thereof a guide groove which guides said optical fiber to said spherical surface part, and which has a pressure groove which extends from said guide groove to the bottom part of said spherical surface part, comprising;

at the initiation of wiring, moving said wheel-less wiring head to a wiring initiation position:

fitting an optical fiber into said pressure groove;
pressing the optical fiber against said wiring substrate with a predetermined pressure; and

moving said wheel-less wiring head along said wiring pattern with respect to said wiring substrate to thereby conduct said wiring wherein the step of pressing the optical fiber against said wiring substrate includes supporting said optical fiber via said pressure groove with a radius of curvature larger than the radius of curvature at which said optical fiber breaks, in a state which said optical fiber is bent by a fixed amount and is pressed onto said wiring substrate.

25. (Previously Presented) An optical fiber wiring method in accordance with claim 24, wherein

when a wiring pattern to be wired is a curved pattern, said pressure groove of said wheel-less wiring head is oriented in a direction at tangent to said wiring pattern.

26. (Previously Presented) An optical fiber wiring apparatus in accordance with claim 1, wherein said guide groove has a upwardly deeper portion for inserting said optical fiber, so as to facilitate the insertion of the lead end of the optical fiber.

27. (Previously Presented) An optical fiber wiring apparatus in accordance with claim 1, wherein

said pressure groove is formed so as to become narrower and shallower as it approaches the lead end of the wheel-less wiring head.